Environmental Protection Department

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Final Closure Plan for Building 419

Volume 1:
Final Closure Plan

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Final Closure Plan for the Building 419 Facility

1.0 Closure Plan

1.1 Introduction

This Closure Plan (**Volume 1**) has been prepared for the Building 419 Hazardous Waste Treatment Facility (B-419 Facility) at Lawrence Livermore National Laboratory (LLNL) and is a detailed strategy of procedures to be implemented in closing the facility. Earlier closure plans for the Building 419 Size Reduction Unit and the Solidification Unit are included as **Volume 2**. The closure plan for underground storage tanks 419-R1U4 and -R1U5 is included in **Volume 3** as is the chronology of correspondence associated with previous closure activity at the B-419 Facility. (**Volumes 2** and **3** have been previously submitted.)

LLNL is owned by the U.S. Department of Energy (DOE) and operated jointly by DOE and its LLNL contractor. The U.S. Environmental Protection Agency (EPA) identification number for LLNL is CA 2890012584.

This Closure Plan is provided to the California Environmental Protection Agency (Cal/EPA) Department of Toxic Substances Control (DTSC) in accordance with correspondence from DTSC, dated October 4, 2000 (RE: Review of Building 419 Closure Activities at Lawrence Livermore National Laboratory [LLNL], EPA ID NO. CA2890012584). Included in the DTSC correspondence was the agency's request for the submittal of one consolidated closure plan for the B-419 Facility that would incorporate all amendments and closure activities. This Plan is subject to the approval of the DTSC and the appropriation of funding from DOE. Upon DTSC approval and DOE funding, LLNL will initiate closure activities according to this Closure Plan. A copy of the Plan will also be provided to any company or individual contracted to perform closure activities.

B-419 is the physical structure that includes Rooms 124, 155, and 167 where hazardous waste treatment activities occurred. The B-419 Facility includes the physical structure of B-419 and the two 500-gallon underground storage tanks (USTs) 419-R1U4 and 419-R1U5 and associated piping that were operated as less-than-90-day tanks.

The B-419 Facility is regulated under the Resource Conservation and Recovery Act (RCRA) and was operated as an interim status treatment facility. The area was used to treat waste containing hazardous and radioactive constituents. This Closure Plan addresses closure of RCRA interim status units in accordance with the requirements of Title 40 of the Code of Federal Regulations, 40 CFR 265.111, and Title 22 of the California Code of Regulations, 22 CCR 66265.111.

The steps outlined in this Closure Plan ensure that hazardous waste generated during closure activities will not escape or be released to the environment, or present a harmful condition to public health or the environment. Wastes generated during closure activities will be placed in separate containers, depending on waste compatibility; and

all waste streams generated during closure activities will be collected, sampled, and disposed of in accordance with applicable regulations. The disposition of hazardous waste generated during previous closure activities is also addressed in **Section 7**.

1.1.1 Typical Weather and Climate

Meteorological data (including wind speed, wind direction, rainfall, humidity, solar radiation, and air temperature) are continuously gathered at LLNL. Mild, rainy winters and warm, dry summers characterize the climate. The mean annual temperature for the Livermore site in 2001 was 14.7°C (58.5°F). Temperatures range from –5°C (23°F) during some predawn winter mornings to 40°C (104°F) during some summer afternoons.

Both rainfall and wind exhibit strong seasonal patterns. These wind patterns tend to be dominated by the thermal draw of the warm San Joaquin Valley that results in wind blowing from the cool ocean toward the warm valley, increasing in intensity as the valley heats up. The wind blows from the northeast primarily during the winter storm season. Most precipitation occurs between October and April with very little rainfall during the warmer months.

Annual wind data for the Livermore site indicate about 50 percent of the wind comes from the southwest to westerly direction. This prevailing pattern occurs primarily during the summer. During the winter, the wind often blows from the northeast. Based on a ten-year record, the highest and lowest annual rainfalls were 541 and 242 mm (21 and 9.5 in.), respectively, and the average annual rainfall was 360 mm (14 in.). In 2001, the Livermore site received 339 mm (13.2 in.) of rain.

1.2 Closure Plan Amendments

This Closure Plan will be amended whenever:

- Unexpected events occur during closure activities that require modification of the approved Plan.
- Changes in state or federal law or regulations affect the Plan.
- If an unexpected event that will affect the Plan occurs before closure has begun, an amendment will be submitted no later than 60 days after the event.
- If an unexpected event that affects the Plan occurs during final closure activities, DTSC will be notified immediately; and an amendment will be submitted within 30 days.

1.3 Historical Use

B-419 was constructed in the late 1940s by the U.S. Navy for various purposes related to airplane maintenance. In later years, the building was used by an LLNL health chemistry program as an assay laboratory. Between 1975 and 1989, LLNL used the building for equipment decontamination and hazardous and mixed waste treatment (size reduction and solidification) activities. Hazardous and mixed waste treatment activities were temporarily discontinued during 1989 pending a seismic evaluation of B-419 to determine if it met the Uniform Building Code (UBC) seismic guidelines. In 1991, an evaluation of the seismic data determined that B-419 could not meet those guidelines; therefore, size reduction and solidification activities were not resumed. The

solidification operation was relocated to LLNL's Building 513 Interim Status Facility, and the size reduction operation was relocated to LLNL's Building 612 Facility.

1.4 Organization of the Closure Plan

This Closure Plan is a consolidation of all previous closure plans and activities at the B-419 Facility, and it also describes the planned final closure activity. Activity that has already taken place includes the closures of the B-419 Solidification Unit, the Size Reduction Unit, and the two 500-gallon retention tanks; and partial sampling and analyses of the B-419 interior structure. Bulk sampling of the facility structure within rooms 124, 155, and 167 was also completed in 2007.

Future planned activity includes structure characterization, and the characterization of the B-419 Facility site to determine if hazardous waste constituents migrated from the facility to the soil. **Volume 1, Section 1,** of this Closure Plan provides an introduction and describes historical use of the facility. A description of the B-419 Facility at LLNL's Main Site is included in **Section 2**. This section describes the Solidification Unit, the Size Reduction Unit, the retention tanks, and other associated activities, including their specific locations, the type of construction materials, and the uses of the units. **Section 3** describes implementation of this Closure Plan, and **Section 4** describes the procedures that will be used to implement the Plan.

Section 5 provides reference to the Sampling and Analysis Plan (i.e., Equipment SAP) of the *Closure Plan for the B-419 Size Reduction Unit and Solidification Unit* (LLNL, 1994; **Volume 2, Appendix A [previously submitted]**) with regard to the B-419 Facility equipment and structure closure activity.

Section 6 provides an overview of the Sampling and Analysis Plan (SAP) for the B-419 Facility closure and addresses soil characterization at the B-419 Facility. This SAP is included in **Volume 1, Appendix A**.

Section 7 reviews past closure activities at the B-419 Facility. **Section 7.1** includes decontamination, removal, and disposition of equipment; decontamination of the structure; and a brief discussion of the analytical data generated as a result of the implementation of the Equipment SAP for the B-419 closure (included as **Volume 2, Appendix A**). **Volume 1, Appendix C [previously submitted],** contains sampling locations and the analytical data associated with those closure activities. Laboratory reports and quality assurance reports are not included in this closure plan because of the large volume of reports. However, copies of all original laboratory reports are available upon request by DTSC.

Closure of the two underground 90-day retention tanks and some of the associated piping is addressed in **Volume 1, Section 7.2,** of this Closure Plan. **Section 7.2** describes the tank removal process, and disposition of the tanks and piping, and includes a discussion of the analytical data generated from sampling near the tanks and associated underground piping. This section also describes the removal of mercury-contaminated soil from beneath the floor in B-419, Room 167. **Volume 1, Appendix C (previously**

submitted), contains the analytical data associated with previous closure activities at B-419.

Section 8 documents Closure Performance Standards for the B-419 Facility. **Section 9** provides an overview of the Site Safety and Health Plan (SSHP) and is supported by the document, "Subcontractor Safety Plan," Section 3.2.4, (included as **Appendix B [previously submitted]**) of Document 2.5, Procured Services ES&H Program, of the *Environment, Safety, and Health Manual* (LLNL, current version). **Section 10** provides the training that will be required of workers involved in closure activities.

Section 11 states the conditions for considering the B-419 Facility closed. It also states that an independent, California-registered, professional engineer will oversee all closure activities. **Section 12** lists the documents that will be maintained during closure activities. **Section 13** explains that LLNL has identified closure milestones, and a milestone chart is provided in this section. The methods that LLNL will use to monitor closure activities are provided in **Section 14**. **Section 15** provide LLNL's exemption from providing cost estimates for closures activities. **Section 16** is LLNL's commitment to notify DTSC as required by law.

Section 17 states LLNL's intention to prepare a post-closure permit application for the B-419 Facility if necessary.

Section 18 contains the reference list, and **Section 19** provides the acronyms used in this Closure Plan.

The *Closure Plan for the Building 419 Size Reduction Unit and Solidification Unit* (LLNL, 1994) is included in **Volume 2 (previously submitted).** The Equipment SAP is presented in **Volume 2, Appendix A;** and the Health and Safety Plan for that closure project is included in **Volume 2, Appendix B.**

Volume 3 (previously submitted) is the *Closure Plan for the Underground Storage Tanks 419-R1U4 and R1U5 and File Index: Chronology of Agency Correspondence.* This volume contains the LLNL Underground Tank Closure/Modification Plan (for Underground Storage Tanks [USTs] 419 R1U4 and R1U5) (LLNL, 1990). The volume also includes a chronological file of the correspondence (and associated documents and closure plan amendments) between LLNL and the oversight agencies. Specific correspondence is referenced throughout this closure plan by the date of the correspondence.

2.0 Description of the Building 419 Hazardous Waste Treatment Facility

The B-419 Hazardous Waste Treatment Facility is located in the southeastern quadrant of the LLNL Main Site near Livermore, CA, as shown in **Figure 1**. **Figure 2** shows the location of LLNL within the San Francisco Bay Area. The building has been used by LLNL for equipment decontamination, size reduction, and hazardous and mixed waste treatment activities since 1975. This closure plan addresses closure of the size reduction unit, solidification unit, and two 500-gallon retention tanks that are associated with the unit.

B-419 is a 7860-square-foot structure consisting of three areas. The center section has a second floor that was used as office space; the other two sections are single story. The layout of the building is shown in **Figure 3**.

2.1 Size Reduction Unit and Activities

Hazardous waste size reduction activities took place in Room 124 and in the Room 124 walk-in fume hood. The walk-in fume hood was equipped with high-efficiency particulate air (HEPA) filters. A schematic showing the location of the size reduction unit is provided in **Figure 4**. The floors in Room 124 are epoxy-coated concrete. Activities conducted within the room consisted primarily of equipment size reduction and decontamination. Following size reduction, a HEPA-filtered vacuum was used to remove loose material from the equipment. Kimwipes and other absorbent materials were then used to wipe down equipment to remove contaminants. Decontamination methods included steam cleaning and other cleaning techniques. Decontamination and size-reduction activities generated waste sludge and spent cleaning fluids that were either managed in containers at the 90-day storage area or placed in the B-419 90-day retention tanks (USTs 419-R1U4 and R1U5). The 90-day storage area and USTs 419-R1U4 and 419-R1U5 are shown in **Figure 3**.

The walk-in fume hood has been decontaminated but still exists in Room 124. All other equipment has been decontaminated and removed from Room 124 in accordance with the *Closure Plan for the B-419 Size Reduction Unit and Solidification Unit* (LLNL, 1994; included as **Volume 2**).

2.2 Solidification Unit and Activities

Hazardous waste solidification activities took place in Rooms 155 and 167. Room 155 has a tile floor overlying concrete and was equipped with hand mixing tools and three laboratory chemical fume hoods (FHE 5, 8, and 12). Room 167 is north of Room 155 and has an epoxy-coated concrete floor and a walk-in fume hood (FHE-6). A portable drum roller was also located in Room 167. A schematic of the solidification unit drum roller is provided in **Figure 5.**

Both transuranic and low specific activity mixed wastes were treated in Rooms 155 and 167. Five to ten gallons of waste were treated monthly. Transuranic (TRU) waste was received in 5-gallon carboys. The wastes, which were primarily acidic, were neutralized prior to solidification. Small aliquots of the waste were transferred to 1-gallon paint cans. The waste was placed in either fume hood FHE-5 or FHE-12, where a solidification agent, such as portland cement, and a catalyst hardener (e.g., sodium silicate) were added to the container. The mixture was then stirred by hand. The process was repeated until thirteen or fourteen 1-gallon paint cans were one-third full. Mixed waste containing fission products was solidified in a similar manner or by using the drum roller/tumbler in Room 167.

All equipment has been decontaminated and removed from Rooms 155 and 167 in accordance with the *Closure Plan for the B-419 Size Reduction Unit and Solidification Unit*

(LLNL, 1994; included as **Volume 2**). The only equipment remaining is the walk-in fume hood (FHC-6) located in Room 167.

Section 7 of this Closure Plan describes the closure activities for the solidification unit and the size reduction unit.

2.3 Retention Tanks

Two 500-gallon, 90-day retention tanks (USTs 419-R1U4 and R1U5) and associated piping system were located in the southwest storage yard in a belowground, open, concrete vault. The location of the retention tanks is shown in **Figure 3**. A schematic of the system is provided in **Figure 6**. The tanks were 4 feet in diameter and 6 feet 6 inches long. They were constructed of fiberglass-reinforced plastic. The two USTs were used to retain cleaning solutions and rinse waters generated from steam-cleaning operations in Rooms 124, 155, and 167. In 1989, the tanks were cleaned, and their use discontinued. They were removed on November 6, 1995, under the oversight of the Alameda County Health Department.

Section 7 describes the tank closure project and includes the disposition of the equipment and analytical data from soil sampling and tank decontamination verification.

2.4 Associated Activities

Two 90-day hazardous waste storage areas, B-419B and B-419C, which are now closed, were established in proximity to the B-419 area. One area was located south of the building, and the other area was southwest of the building. Both areas were used for the temporary (less than 90 days) storage of waste and equipment prior to decontamination and/or size reduction.

B-419B consisted of an 8-foot-by-12-foot transportainer that was located on the south side of B-419. The B-419B waste accumulation area (WAA) was used to store waste that was generated from LLNL Plant Engineering Battery Shop operations.

The B-419 west yard comprised the B-419C WAA. It was within a cyclone fence and consisted of asphalt and concrete pads. The WAA was used to store roll-off bins that held B-419 roofing waste.

LLNL's WAA closure guidelines, which incorporate state requirements (as codified in Title 22 of the California Code of Regulations 66262.34[a][1][A], 66265.111, and 66265.114) require that the environmental condition of a WAA be ascertained prior to closure; WAAs meeting "clean-closure" standards can be closed following the "Phase I" closure process. Clean-closure determinations are made by performing the following:

- Assuring that all hazardous waste has been removed from the WAA.
- Reviewing essential records (e.g., WAA Inspection Records, DOE Occurrence Reports, if applicable) to ensure that the WAA was operated free of chemical spills or other environmental releases.

- Interviewing program personnel responsible for WAA operations.
- Visually inspecting the WAA for indicators of environmental contamination (looking for stains, spilled material, or other physical signs of environmental occurrences).
- Documenting the closure activity.

Both WAAs B-419B and B-419C were closed consistent with the closure guidelines described above.

The B-419 office areas and the Battery Shop (added in 1970) were not used for hazardous waste operations. Also, the area north of B-419 was used for receiving, staging and occasional temporary storage of wastes.

2.5 Hazardous Waste Treated at the B-419 Hazardous Waste Treatment Facility

A summary of the potential historical contaminants associated with the B-419 treatment processes is presented in **Table 1**. Potential contaminants were identified based on operational history.

2.6 Waste Description, Maximum Volume Stored/Treated and Inventory Elimination

The B-419 Facility is not currently in operation, and no hazardous waste is present at the facility. During the time that the facility was operational, the maximum amount of equipment/items that could be size-reduced in a single day was estimated at 5 short tons per day. The maximum treatment capacity of the Solidification Unit was approximately 800 gallons of waste per day in the drum roller, and 5 gallons per hour manually under the chemical fume hood.

2.7 Historical Releases from the B-419 Facility

Prior to the beginning of tank closure activities, a helium injection/detection test was performed on the piping associated with the retention tank system. The test indicated that there were leak sites in the piping. **Section 7.2** describes the contamination associated with the retention tank system.

In addition, during the closure of underground piping associated with the retention tank system, mercury contamination was discovered in the soil beneath the floor of Room 167. On November 14, 1996, LLNL sent a letter to James Pappas, Branch Chief, Facility Permitting, DTSC, notifying him that the B-419 closure project had been delayed due to the discovery of this soil contamination. Additional information regarding the soil contamination is included in **Section 7.1** of this Closure Plan.

3.0 Implementation of the Closure Plan

This B-419 Final Closure Plan will be implemented based upon approval by DTSC and the appropriation of funding from DOE. Once approved and funded, the closure plan for the

B-419 facility will be implemented in accordance with the schedule outlined in **Figure 7**. LLNL will notify DTSC at least 60 days prior to implementation of closure activity.

LLNL will provide a copy of this Closure Plan to any contractors who may be hired to implement this Closure Plan.

4.0 Closure Procedures

LLNL prefers to clean close B-419; however, past releases of hazardous and/or mixed wastes that cannot be removed or decontaminated may make clean closure unachievable.

4.1 Unit Disposition Summary

Disposition of equipment associated with previous B-419 closure activity has been addressed in **Section 7** below.

4.2 Decontamination and Verification

Decontamination of the B-419 structure and most of its equipment occurred during previous closure activity, as described in **Section 7**. Based upon the waste acceptance criteria of the waste disposal facility and in accordance with the regulations decontamination or removal of "hot spots" may be conducted, see Sections 4.3 and 4.6. The needs and details of these activities will be presented in the Final Closure Report.

All rinsate and materials used in any decontamination process will be collected, sampled, and analyzed for characterization purposes. If rinse water is determined to be non-hazardous and if it meets City of Livermore discharge criteria, it will be discharged into the sanitary sewer. Otherwise, it will be managed as radioactive, hazardous or mixed waste, as appropriate, and treated on site or transported off site to an authorized facility for treatment and disposal.

4.3 Decontamination Procedures

If additional decontamination of structures, surfaces, and walk-in fume hoods in the B-419 Facility is needed, it will be done using appropriate methods and procedures. The decontamination method selected from **Tables 3** and **4** will be based on the type of contaminants anticipated.

Secondary containment will be provided for all decontamination activities. The decontamination process is described below.

1. The B-419 Facility will be decontaminated using the decontamination methods described in **Table 3**.
2. All wastewater generated from decontamination activities will be collected. The wastewater will be pumped from the secondary containment structures into a portable tank using an auxiliary pumping system. Any residual liquid will be removed with absorbent material that will then be collected in a 55-gallon drum.

This absorbent material will be handled as appropriate, based on the analytical results of the wastewater generated during decontamination (see **Table 2**). Decontamination activities may generate mixed waste.

3. After decontamination has been verified, all decontamination solutions will be sampled and analyzed. Depending upon sample results, a determination will be made on follow-up treatment or disposal options. **Table 4** provides an estimate of quantities of waste to be generated, should further decontamination be necessary.

4.4 Disposition of Equipment and Associated Structures

Disposition of the equipment that was used in B-419 treatment processes and removed in partial closure activities is described in **Section 7**.

Contaminated equipment and structures will be disposed of as radioactive, or mixed waste, as appropriate.

Debris waste will be identified according to 22 CCR 66260.10 and handled as outlined in 22 CCR 66268.45. 22 CCR 66260.10 defines debris as manufactured objects greater than 60 millimeter in size that are intended for disposal. 22 CCR 66268.45 enables debris to be treated using specified methods. The treated debris is excluded from the definition of hazardous waste. Regulations further state that this exclusion requires that the debris not exhibit a characteristic of hazardous waste after treatment. Persons claiming this conditioned exclusion of treated debris will have the burden of proving by clear and convincing evidence that the material meets all the exclusion requirements (22 CCR 66261.3[e]).

Asbestos Containing Materials (ACMs) are present in several areas throughout the B-419 Facility and may include:

- Composite sheet rock/joint compound/mastic tape
- Surfacing materials, such as wallboard texturing and structural fireproofing
- Transite wallboard
- Ceiling tiles
- Thermal System Insulation (TSI), such as pipe lagging, pipe elbows and ducting insulation
- Flooring products, such as floor tiles, linoleum and floor mastic
- Roofing materials, such as roofing felts and paints.

Prior to demolition, all ACM will be identified by survey and/or sampling. ACM that is categorized as Regulated Asbestos Containing Material (RACM) or that can potentially become RACM upon demolition activities will be removed prior to demolition in accordance with the Bay Area Air Quality Management District (BAAQMD) Regulation 11, Rule 2. Equipment used for treatment of listed waste will be characterized as such and disposed of as hazardous waste, or mixed waste, if appropriate.

4.5 Building Structures

Building structures were sampled and analyzed as outlined in the Equipment SAP of the *Closure Plan for the Building 419 Size Reduction Unit and Solidification Unit* (LLNL, 1994; included as **Volume 2, Appendix A**). Further sampling and analyses were conducted in 2007, see Appendix D for sampling activities including sampling locations and analytical results. B-419, including the slab, will be demolished and removed.

Based on the knowledge of the waste operations historically conducted, results from sampling efforts, and the desire to move forward in a most efficient manner, LLNL has decided to characterize the debris resulting from the demolition of the entire Building 419 structure as follows:

- Room 124 as radioactive waste
- Rooms 155, 167 as mixed waste
- Areas where RCRA activities did not take place such as the utility rooms, office areas, bathrooms, etc. tentatively as radioactive waste
- The tank vault located in the west yard outside of the building as mixed waste.

Building 419 structure, for the purpose of this determination, does not include the concrete slab floor of the building footprint. Further characterization sampling and analysis for these areas will occur, see Appendix A of this closure plan for details.

4.6 Demolition

LLNL plans to demolish Building 419. Portions of the building will be dismantled as appropriate, in order to minimize costly waste generation, remove asbestos-containing materials from the facility as an independent operation, and reduce the amount of dust generated during demolition activities. The demolition work will consist of a variety of tasks, including the following:

- Dismantling and management of walk-in fume hoods as appropriate.
- Disconnection of power utilities.
- Demolition of structure walls and removal of slab foundation.
- Removal of remaining under-slab pipes associated with the treatment unit.
- Other miscellaneous demolition work.

As a part of demolition of building structure, "hot spots" will be identified in accordance with applicable federal regulations (e.g., 10 CFR 835 for radioctivity and 10CFR 850 for beryllium) using sample and analysis and survey results. Depending on the nature and extent of the contamination, and in consultation with an industrial hygienist and health physicist, one or more of the following methods maybe used on the hot spot before the demolition of the entire building. The methods include, but are not limited to, the following:

- Decontamination,
- Applying fixative,
- Disassembling,
- Saw cutting,

- Scabbling and
- Scraping.

Fugitive dusts will be controlled during demolition activities associated with the B-419 closure project. A particle analyzer will be used to measure suspended dust particles; and spray misting will be used to control dust particles. A water source for that purpose will be available at all times.

4.7 Containers Used for Management of Waste Generated during Closure Activities.

Waste containers used to manage waste generated during closure activities will be the same type of containers used during the active life of the facility. The container types and sizes are listed in **Table 5** and are the same as those described in the Waste Analysis Plan included in the Part B Permit application (LLNL, 1998b). Containers are selected to ensure compatibility with the waste to be contained.

4.8 Disposition of Materials Generated during Closure Activities

Equipment that may have come into contact with hazardous waste in the implementation of this Closure Plan will be decontaminated by suitable washing and/or wiping as a part of this closure operation or disposed of as hazardous waste per appropriate regulations.

All expendable solid materials (wipes, rags, etc.) that are used in the above decontamination steps and that come in contact with hazardous wastes will be collected in containers and disposed of as hazardous waste or, if indicated, mixed waste.

Representative samples of all containers of washing liquids collected while implementing the closure will be obtained. They will be analyzed in order to characterize the contents as either hazardous, mixed, or non-hazardous waste. All samples will be collected per the SAP (**Volume 1, Appendix A**). In all cases where analysis is necessary, a California-certified laboratory will perform the analysis. Sample chain-of-custody procedures will be documented.

Wastes will be managed (removed, transported, stored, or disposed of) in accordance with the LLNL Radioactive and Hazardous Waste Management (RHWM) Division's Waste Acceptance Criteria (WAC). Wastes that are identified as hazardous or mixed, based on the SAP in **Volume 1, Appendix A**, will be treated or stored at LLNL hazardous waste management facilities or shipped to an authorized, off-site treatment, storage, and disposal facility (TSDF) using hazardous waste manifests.

4.9 Off-site Treatment and/or Disposal

LLNL ships hazardous waste to off-site authorized facilities, including, but not limited to, the following:

Name of the Off-site Authorized Facility	Facility Address	Distance to the Facility from LLNL (miles)
Teris, Inc.	1737 E. Denni St., Wilmington, CA 90744	359
US Ecology of Idaho	10.5 miles NW of Grand View on Hwy 78; turn north on Lemley Rd. P.O. Box 400 Grand View, ID 83624	625
Heritage Environmental Services, Inc.	5122 E. Storey Rd., Coolidge, AZ 85228	771
Nevada Test Site	NSTec Nevada Test Site, Zone 2 Mercury NV 89023	550
Clean Harbors	2500 West Lokern Rd. Buttonwillow, CA 93206	222
Trade Waste/Chemical Waste Management	7 Mobile Ave., Sauget, IL 62201	2070
Energy Solutions	605 N 5600 W Salt Lake City, UT 84116 Tel. 801-532-1330	712
Altamont Landfill*	10840 Altamont Pass Rd. Livermore, CA 94550	6
Chemical Waste Management	35251 Skyline Rd. Kettleman City, CA 93239	175
Diversified Scientific Services, Inc.	657 Gallaher Rd Kingston, TN 37763	2410
Permafix	663 Emory Valley Rd. Oak Ridge, TN 37830	2400
Materials & Energy Corporation	2010 Hwy 58, Suite 2010, Oak Ridge, TN 37830-10	2400

*Accepts non-hazardous waste only, but also manages waste asbestos

LLNL may use these facilities or other authorized facilities as they become available. All waste to be transported off site will be packaged and labeled in accordance with applicable state and federal regulations, including U.S. Department of Transportation (DOT), U.S. Environmental Protection Agency (EPA), and DTSC requirements.

Hazardous waste manifests, Land Disposal Restrictions (LDR) certification, and any other pertinent documentation will be maintained and provided in the B-419 Facility Closure Report for all hazardous/mixed waste generated during closure activities.

4.10 Transportation Distances to Off-site Facilities

The approximate transportation distances to the off-site treatment and disposal facilities from the LLNL Main Site are shown in the table in **Section 4.10**.

5.0 Sampling and Analysis Plan for the B-419 Facility Closure

Sampling and analysis for the B-419 equipment and structure was conducted in 2007 as described in Section 7.2.10. **Section 6** below discusses the soil sampling plan for final closure of the B-419 Facility.

6.0 Containment Verification—B-419 Facility Closure Soil Sampling Plan

A Sampling and Analysis Plan (SAP; **Volume 1, Appendix A**) has been developed to verify the integrity of the B-419 secondary containment systems and to characterize the soil under the building structure and the retention tank system. Concrete-asphalt-soil (CAS) samples will be collected from selected locations at the Building 419 Facility as shown in Figure A-2 of the SAP, and the results will be compared to the maximum allowable concentrations for metals in soil and the radiological background levels established through soil sample acquisition throughout the LLNL site. If inspection of the containment system reveals any cracks in the secondary containment pad, a sample will be taken from the soil beneath the crack to determine if contamination has occurred. Sampling will also occur at selected locations where ancillary piping associated with the retention tank system has been removed during previous closure activity, as well as in areas where ancillary piping remains in the subsurface beneath the building. The sampling methods used are found in EPA-600/2-80-018, *Samplers and Sampling Procedures for Hazardous Waste Streams* (EPA, 1980).

The background soil (SO) samples that will be used to establish the maximum allowable concentrations for metals in soil, as well as the radiological background levels, will be collected from the locations shown in Figure A-3 of the SAP.

7.0 Past Closure Activities

Partial closure activities that have occurred at the B-419 Facility include the implementation of the *Closure Plan for the Building 419 Size Reduction and the Solidification Units* (LLNL, 1994; included as **Volume 2**), and the closure of two underground 500-gallon wastewater retention tanks as described in the Underground Storage Tank Closure/Modification Plans (for Tanks 419-R1U4 and R1U5) (LLNL, 1990; included in **Volume 3**). Amendments to the Underground Storage Tank Closure Plan are also included in **Volume 3,** *File Index: Chronology of Agency Correspondence.*

Closure activity took place over an extended period of time and involved several amendments of both closure plans. **Volume 3** contains *File Index: Chronology of Agency Correspondence,* a summary of the correspondence that took place between March 1992 and March 1999 with the oversight agencies regarding these closure activities.

Sections 7.1 and **7.2** contain summaries of the closure activities for the B-419 Size Reduction Unit and Solidification Unit and the USTs 419-R1U4 and -R1U5, respectively.

7.1 Closure of the B-419 Size Reduction Unit and Solidification Unit

The scope and purpose of the *Closure Plan for the Building 419 Size Reduction and the Solidification Units* (LLNL, 1994; included as **Volume 2**) was to decontaminate and remove the equipment associated with B-419 and to dispose of the equipment either as hazardous waste or non-hazardous waste, as appropriate, based on the results of the Equipment SAP of the *Closure Plan for the Building 419 Size Reduction and the Solidification Units* (LLNL, 1994; included as **Volume 2, Appendix A**). The purpose of this project was also to decontaminate the internal building structure.

The Size Reduction Unit, Solidification Unit, and associated equipment were decontaminated, removed, and disposed of during 1996, following the procedures described in the *Closure Plan for the Building 419 Size Reduction and the Solidification Units* (LLNL, 1994; included as **Volume 2**). The process for decontaminating equipment, the analytical verification of decontamination, and the disposition of equipment are described in this section. A discussion of structural building component decontamination and sampling is also included.

7.1.1 Summary of Size Reduction Unit and Solidification Unit Closure Plan Amendments

In March 1992, LLNL submitted two separate final closure plans to DTSC for approval: *Closure Plan for the Building 419 Size Reduction Unit* and *Closure Plan for the Building 419 Solidification Unit*. (The cover letters for those documents are included in **Volume 3,** *File Index: Chronology of Agency Correspondence*). DTSC responded to LLNL's request for approval of the closure plans with a Notice of Deficiency, dated April 8, 1992. LLNL revised the plans to address DTSC's issues and re-submitted the revised plans to DTSC in June 1992. By September 1994, LLNL had not yet received approval from DTSC for either of the closure plans and at this point submitted another revision. The revision included consolidation of the final closure plans for the size reduction unit and the solidification unit into one partial closure plan (*Closure Plan for the Building 419 Size Reduction Unit and Solidification Unit* [LLNL, 1994; included as **Volume 2]**). This revision also included notification to DTSC that the anticipated date that closure would be completed would be in late 1996 rather than 1994.

Subsequent notices were sent to DTSC revising the partial closure completion date. On November 14, 1996, LLNL sent a letter to James Pappas, Branch Chief, Facility Permitting, DTSC, notifying him that the B-419 Facility closure project had been delayed due to the discovery of soil contamination during closure activities for the B-419 retention tanks. The notification to Mr. Pappas extended LLNL's anticipated closure date to September 1997. Additional revisions to the *Closure Plan for the Building 419 Size Reduction Unit and Solidification Unit* (LLNL, 1994; **Volume 2** of this Closure Plan) were as follows:

- September 12, 1997—Notification to DTSC of delay in closure plan and anticipation of completion date of December 31, 1997.
- December 8, 1997—Notification to DTSC of delay in closure plan and anticipation of completion date of June 30, 1998.

- July 28, 1998—Notification to DTSC of delay in closure plan and anticipation of completion date of March 31, 1999.

Copies of the correspondence described above are included in *File Index: Chronology of Agency Correspondence in* **Volume 3**.

7.1.2 Closure Activity

Work was completed for the B-419 Facility equipment and structure in two separate phases. The equipment phase was completed first and consisted of work on the items referenced in Section 5.5.1 of the Equipment SAP of the *Closure Plan for the Building 419 Size Reduction and the Solidification Units* (LLNL, 1994; included as **Volume 2, Appendix A**) The second phase consisted of the building structure and included items listed in Section 5.5.2 of the Equipment SAP (**Volume 2, Appendix A**).

7.1.3 Characterization of Equipment

A preliminary survey and sampling of equipment was completed in 1994 that clarified which pieces of equipment were not contaminated. Material was separated into two categories, clean and potentially contaminated. Further characterization of the equipment continued in accordance with the Equipment SAP (**Volume 2, Appendix A**). Contaminated equipment was decontaminated, sampled, re-evaluated for contamination, and disposed.

7.1.3.1 Equipment Decontamination and Dispensation Summary

Size reduction of equipment took place in the respective rooms where the equipment was located. After size reduction, the equipment was decontaminated. Decontamination of equipment was performed according to Section A-9 of the *Closure Plan for the Building 419 Size Reduction Unit and Solidification Unit* (LLNL, 1994; included as **Volume 2**). Most of the decontamination work took place in the Room 167 walk-in fume hood because it afforded the largest area of workspace. Decontamination rinse water was collected and managed as waste.

Following decontamination, the equipment was sampled and managed based upon sampling results. Information tracking the management of the B-419 equipment, including sampling results, release documentation status, and final disposition as scrap or waste was maintained on a database. The "release" process involved evaluation of analytical results by a chemist, an industrial hygienist, a health physicist, and an environmental analyst. If released, the material was managed as scrap. If contamination could not be removed, the material was disposed of as hazardous, mixed, or low-level radioactive waste, based on the analytical results. All low-level radioactive wastes that were sent to disposal sites were certified by a waste certification engineer to meet WAC for the designated disposal site.

A total of 4000 cubic feet of equipment was released as scrap, and six pallets were released to a landfill. The amount of low-level waste generated was 3200 cubic feet; the amount of mixed waste was 800 cubic feet; the amount of California combined waste

was 640 cubic feet. **Table 6** provides the disposition of B-419 Facility equipment associated with this closure project.

7.1.3.2 Structural Sampling and Analysis Program Summary

Sample Selection

All sample locations were randomly selected using an electronic random number generator and the following scheme:

- The area of each surface (i.e., ceiling, floor, and each wall) was measured and recorded in square feet.
- The area of the sampling location (quad) and sampling frequencies were determined according to the Equipment SAP (**Volume 2, Appendix A,** Section 5.4).
- The area of the quad was divided into the total area of each surface, generating the available population for that surface.

The randomly selected sample locations were plotted geographically and are referenced with their matching coordinates in **Volume 1, Appendix C, Figures C-1** through **C-3.**

Sample Acquisition

Samples were taken in a stratified manner in order to evaluate the presence of contamination and its possible transport to lower strata. Samples for the building structure were taken in the following sequence:

1. Survey.
2. Swipe.
3. Floor tiles (Room 155 only).
4. Bulk scrapings.

Analytical data was tabulated and, as a part of this Final Closure Plan, was evaluated, and future samples will be collected and analyzed according to the SAP in **Volume 1,Appendix A**. Summaries of the analytical results for B-419, Rooms 124, 155, and 167 are provided in **Volume 1, Appendix C, Tables C-1** through **C-3,** respectively. Decontamination procedures will be implemented (if economically feasible) as described in **Section 4.3** of this Closure Plan, and the structure will be demolished and managed as hazardous, mixed, or low-level radioactive waste, based on the analytical results.

7.1.4 Closure Certifications

On December 31, 1996, LLNL received (from Chow Engineering, Inc.) the Independent Engineering Report and Certification for Closure of Building 419 Equipment, including the size reduction unit and solidification unit.

Chow Engineering, Inc., also provided the Independent Engineering Report and Certification for Closure of Building 419, including the roof and internal structures, on March 26, 1999.

Copies of both reports are included in *File Index: Chronology of Agency Correspondence* in **Volume 3.**

7.2 B-419 Retention Tank System Closure

Two 500-gallon, 90-day underground tanks associated with hazardous waste management activities in B-419 were removed in 1995 in accordance with the Closure Plan for Underground Tanks 419-R1U4 and -R1U5 (LLNL, 1990; dated 6/6/94 and included in **Volume 3**). The Closure Plan was submitted to the Alameda County Environmental Health Department and approved by the County in June 1994. This partial closure project was performed under their oversight.

This project summary includes the discovery and the subsequent investigation of potential leak sites in the tank system's underground piping, the tank system closure process, analytical data associated with the closure process, and procedures for management of wastes generated during the project. The summary also includes the discovery of soil contamination beneath the slab foundation in Room 167 during the removal of ancillary piping, and the actions taken to remove contamination.

The location of the two 500-gallon retention tanks and their associated piping system are shown in **Figure 3**. The tanks were located in the southwest storage yard in a below-ground, open, concrete vault. Both tanks were 4 feet in diameter and 6 feet 6 inches long and were constructed of fiberglass-reinforced plastic. The tanks were used to retain cleaning solutions and rinse waters generated from steam-cleaning operations in B-419, Rooms 124, 155, and 167.

7.2.1 Summary of B-419 Retention Tank System Closure Plan Amendments

As the closure project progressed, several Amendments to the Closure Plan were prepared and submitted to Alameda County. A copy of each Amendment is provided in *File Index: Chronology of Agency Correspondence,* **Volume 3**. The Amendments are listed below and each Amendment is described further in this section.

- Amendment 1: Based on the release discovery, an Amended Closure Plan was submitted to Alameda County on September 15, 1995, and received approval on September 28, 1995.
- Amendment II: On June 3, 1995, LLNL submitted Amendment II of the Closure Plan for Underground Storage Tanks 419-R1U4/5 to include piping closure activity under the slab of B-419, Room 167.
- Amendment III: On July 29, 1996, LLNL submitted Closure Plan Amendment III and Sampling Plan for the 419-R1 Tank System Piping Closure, B-419, Room 167. The plan proposed soil removal activity and a sampling plan to determine if excavation was successful in removing the contamination.

- Amendment IV: On September 30, 1996, Closure Plan Amendment IV was submitted to Alameda County, proposing to remove associated wastewater system piping located underneath the concrete floor of Room 124.
- Amendment IV, Revision 1: This Revision was submitted on November 25, 1996. The revision modified Amendment IV by proposing to close-in-place the piping located beneath Room 124. The proposal was approved on December 17, 1996.
- Amendment V: On March 19, 1997, LLNL submitted Closure Plan Amendment V to Alameda County. Amendment V documented closure of the underground concrete vault.

7.2.2 Discovery and Investigation of Leak Sites in the Tank System's Underground Piping

Closure activities commenced on April 3, 1995, with the preliminary excavation and inspection of the piping system adjacent to the underground concrete vault containing USTs 419-R1U4 and -R1U5. On April 14, 1995, a helium injection/detection test was performed on the piping associated with the retention tank system. The test indicated that there were suspected leak sites in the piping, as shown in **Figure 8**. The test showed a small leak at each of the three cleanouts, and a significant leak site at the location of the "T" in the underground piping.

7.2.3 Sampling and Analysis Events at Suspected Leak Sites

On May 16, 1995, radiological pre-screening samples were collected from soil at the suspected leak sites by auguring to the level of the underground piping. Fourteen soil samples were collected below the bottoms of the boreholes using stainless steel tubes and a slide hammer. Samples were analyzed for gross alpha radioactivity, gross beta radioactivity, gamma radioactivity, and tritium radioactivity. Tritium was detected in three samples at concentrations of 0.58 pCi/g, 12 pCi/g, and 23 pCi/g. Two of these samples exceeded the criteria limit (5 pCi/g) for tritium in soil. Gross alpha radioactivity was detected in four samples, ranging in concentration from 2.5 pCi/g to 38 pCi/g. One sample (38 pCi/g) exceeded the criteria limit for gross alpha radioactivity in soil. The criteria limit for gross alpha radioactivity in soil is 15 pCi/g.

Criteria limits were developed by LLNL and were used as threshold values for "radioactivity (rad) added." "Rad added" means that radioactivity was identified in the sample in amounts exceeding natural radioactivity plus fallout resulting from atmospheric testing of nuclear weapons.

Based on the release discovery, an Amended Closure Plan (Amendment 1) was submitted to Alameda County, and it received approval on September 28, 1995. On October 10, 1995, excavation was completed to the top of the tank piping, and a second set of samples was collected and analyzed for halogenated volatile organics, aromatic volatile organics, metals, and pH. Sample locations are shown in **Volume 1, Appendix C, Figure C-4**. The analytical results are also provided in **Volume 1, Appendix C, Table C-4**.

Methylene chloride was found in each sample at a concentration range between 0.0016 mg/kg and 0.0022 mg/kg. The method blank concentration for methylene chloride was 0.0018 mg/kg, indicating that the levels of methylene chloride seen in the October 10th soil samples could be attributed to laboratory contamination. 1,1,2-Trichloro-1,2,2-trifluoroethane was detected in several samples with concentrations ranging between 0.00070 mg/kg and 0.0011 mg/kg. Toluene was detected in one sample at 0.0091 mg/kg. As shown in **Table C-4**, the Soluble Threshold Limit Concentration (STLC) analysis showed barium and zinc in several sample locations. Lead and mercury were detected in one sample at 6.6 mg/L and 0.025 mg/L, respectively. Various metals were detected at various concentration ranges as a result of Total Threshold Limit Concentration (TTLC) analysis. Arsenic concentrations ranged from 2.0 mg/kg and 4.1 mg/kg. Mercury was detected in several samples with concentrations ranging from 0.92 mg/kg to 8.3 mg/kg.

Additional samples were collected and analysis was performed during October 26 and 27, 1995, for radioactivity and chemical constituents at the suspected leak sites. The sample locations are shown in **Volume 1, Appendix C, Figure C-5**. Soil samples were taken from above and beside the piping at the indicated leak sites, and the analysis showed radioactivity above background levels. Twenty radiological samples were collected beneath the piping and analyzed for gross alpha, gross beta, tritium, and gamma radioactivity. Seven showed tritium radioactivity added, with concentrations ranging from 17 pCi/g to 40 pCi/g. Gross alpha radioactivity was detected at five sampling locations; however, the concentration levels were not above the criteria limit for radioactivity in soil. The tank closure project was delayed at this point while a plan of action was developed.

During the October 26 and 27, 1995, sampling period, 22 samples were also collected and analyzed for chemical constituents. Shallow samples were collected by hand auguring to the correct depth. A slide hammer was used to obtain the samples. The soil samples taken from 6 to 8 feet below the surface were collected by first using a power augur to bore a hole to the desired depth and then by using a hand augur to clean the borehole. A slide hammer was then used to collect the samples. Metals were detected at several locations. In addition, one sample showed trichloroethane at 0.69 ppb. The results of these analyses are shown in **Volume 1, Appendix C**, **Table C-5**.

7.2.4 Removal of Underground Piping Outside B-419 North of Tank Vault

Between October 31, 1995, and November 3, 1995, the underground piping exposed during sampling procedures and the above-ground tank system piping was cut into 4-foot sections using a hydraulic pipe snapping tool. The cut sections of piping were wrapped in plastic sheeting and sealed with tape. The pipe ends at the B-419 wall were capped or plugged.

On December 12, 1995, LLNL received verbal approval from Rob Weston of Alameda County to fill and restore the piping excavation. The Final Report was submitted to Alameda County for the unauthorized release investigation on December 27, 1995. The report stated that, based on the analytical results and the selected remedial action for tritium described in LLNL's Record of Decision (ROD), the piping trench would be

filled with clean, compacted fill, and that the project lead would be transferred to LLNL's Environmental Restoration Division. A copy of the notification is provided in *File Index: Chronology of Agency Correspondence,* **Volume 3**.

Asphalt rubble, trench-fill gravel, soil, and piping generated during the excavation of piping north of the tank vault were characterized for disposal. Soil piles SP124, SP130, SP131, SP132, SP151, and SP 152 were approved for disposal at the Altamont Landfill and Resource Recovery Facility, 10840 Altamont Pass Road, Livermore, California. Excavated asphalt and concrete from this project (RP123 and RP 153) were characterized as non-hazardous and non-radioactive. RP123 and RP 153 were approved for disposal at Altamont Landfill. The excavated piping, soil borings, and personal protective equipment used during the project were characterized as mixed waste and are managed in the hazardous waste management facility at Building 612. (Soil and rubble pile characterization data are provided in **Volume 1, Appendix C, Table C-10**.)

7.2.5 Removal of Retention Tank Piping beneath Room 167

Additional activity was initiated in June 1996 that was associated with the B-419 tank closure project. LLNL submitted Amendment II of the Closure Plan for Underground Storage Tanks 419-R1U4/5; Amendment II (see **Volume 3,** *File Index: Chronology of Agency Correspondence*) includes piping closure activity under the slab of B-419, Room 167. Upon approval of the amended plan, a section of the slab was removed to access the underground piping. A representative from the Alameda County Health Department, Department of Environmental Health witnessed sampling activity on June 20. After the County representative left the site and during additional excavation activity, a LLNL technician discovered visible beads of elemental mercury within the excavation. A visual inspection of the uncovered piping section revealed no breaks, leaks, or deterioration in the retention tank system piping or the pipe connections; however, pieces of old piping were discovered in close proximity to the existing pipe, indicating the possibility of previous work on the section. Additional samples were taken on June 21 to characterize the area of visible contamination.

The analytical data for samples taken on June 20 and 21, 1996, are summarized in **Volume 1, Appendix C, Table C-6**. Toxicity Characteristic Leaching Procedure (TCLP) analysis showed concentrations of mercury ranging from 1 mg/kg to 100 mg/kg in soil. Lead concentrations ranged from 8.5 mg/kg to 800 mg/kg. An aqueous sample showed mercury at 23 mg/L. Another aqueous sample was analyzed for volatile organic aromatic constituents and showed benzene and xylene at concentrations of 10 μg/L and 6 μg/L, respectively.

At this point, the project was delayed while a strategy was developed to assess the extent of contamination and to determine appropriate cleanup methods.

On July 29, 1996, LLNL submitted Closure Plan Amendment III and the Sampling Plan for the 419-R1 Tank System Piping Closure, B-419 – Rm. 167 to Alameda County. The plan proposed soil removal activity and a sampling plan to determine if excavation was successful in removing the contamination. A copy of this correspondence is provided in **Volume 3,** *File Index: Chronology of Agency Correspondence.*

Soil was excavated from the walls of the piping "T" area" (where mercury was discovered) to a depth of 5 feet. In addition, soil was excavated a minimum of 1 foot beyond any visible mercury. All excavated soil was placed in drums or bins for proper storage. **Figure C-7** is a sketch showing excavation and sampling locations of the 419-R1 piping in Room 167. This is a drawing of the excavated area and the Closure Plan Amendment III sampling locations. The samples that were collected at this time were composites taken after the visible contaminated soil had been removed. Mercury concentrations in the composites ranged from 0.09 mg/kg to 19.0 mg/kg. The analytical data for this sampling is summarized in **Table C-7**.

On October 18, 1996, LLNL submitted the final report of the Room 167 investigation and cleanup to Rob Weston of Alameda County. A copy of the report is included in *File Index: Chronology of Agency Correspondence,* **Volume 3**. The report included a proposal to line the Room 167 trench with a geotextile membrane; fill the trench with clean, compacted fill; restore the concrete floor; and re-paint the floor with epoxy. LLNL received a letter on December 17, 1996, from Alameda County that concurred with the LLNL proposal; and trench closure activities began in Room 167 on January 6, 1997.

7.2.6 Closure of the Retention Tank System Piping Associated with Room 124 Hazardous Waste Activities

On July 8, 1996, the concrete was saw-cut from above the underground piping outside Room 124 of B-419. The underlying fill gravel was removed to expose the piping. On July 22, 1996, soil samples were collected from two locations below the piping, and two sections of the piping were removed. (The locations where the sections were removed are indicated in the SAP [**Volume 1, Appendix A, Figure A-1**].)

The soil samples collected on July 22, 1996, in the piping removal excavation outside and west of Room 124, B-419, were analyzed for TTLC metals and radioactivity. The locations where samples were taken are shown in **Figure C-8**. The results are shown in **Table C-8**.

On September 30, 1996, Closure Plan Amendment IV was submitted to Alameda County. It proposed the removal of the associated wastewater system piping located beneath the concrete floor of Room 124. Subsequently (based on the analytical results of the July 22, 1996, sampling event and the observation that the piping was in good condition), LLNL requested approval from Alameda County to fill and pave the excavated area. Verbal approval was received from Rob Weston. In addition, LLNL submitted Amendment IV, Revision 1, on November 25, 1996, to Alameda County. This Revision modified Amendment IV by proposing to close-in-place the piping located beneath Room 124. The proposal was approved on December 7, 1996; and activities to close the piping in place were completed in February 1997.

7.2.7 Closure of Tanks 419-R1U4 and 419-R1U5

The B-419 underground wastewater retention tanks (419-R1U4 and 419-R1U5) were washed and rinsed in 1989 when they were removed from service. On June 20 and 21, 1995, swipe samples were collected from the exterior and the interior surfaces of both

tanks and analyzed for radioactivity, organics, and metals. The results of analyses showed that values for fixed and removable alpha and beta radioactivity exceeded criteria limits. No organic constituents were detected. Trace levels of regulated metals were detected on the interior and the exterior surfaces as shown in **Table C-9**. The tanks were characterized as non-hazardous radioactive waste.

On November 6, 1995, the tanks were removed from the underground concrete vault. The tanks are currently stored and managed as radioactive waste at the LLNL hazardous waste management facility at Area 612.

7.2.8 Closure of the Underground Vault that Contained Tanks 419-R1U4 and 419-R1U5.

On March 19, 1997, LLNL submitted Closure Plan Amendment V to Alameda County. Amendment V documented the closure of the underground concrete vault. The vault interior surfaces were pressure-washed. A survey was performed to determine the effectiveness of the wash using a field radiation-detection instrument. The survey determined that radioactive contamination remained fixed on the vault interior surfaces. The vault was abrasive-blasted to remove the epoxy coating, which was the suspected source of the radioactive contamination. A field survey performed subsequent to the abrasive blasting continued to identify small radioactive sites in the bottom of the vault. A concrete chip was removed from the bottom of the vault and analyzed for radioactivity. The results of the analysis exceeded the criteria limits for gross alpha radioactivity, gross beta radioactivity, and tritium radioactivity. TTLC analysis also identified lead at a concentration of 1000 mg/kg. Additional sampling of the concrete vault will be completed to help determine the extent of contamination. Details about the specific sampling approach for the vault are described in the Sampling and Analyses Plan in **Appendix A**.

The waste abrasive grit generated during the project and the sections of piping removed from the tank were managed as mixed waste. The concrete vault remains in place. However, LLNL intends to remove the concrete vault from the ground once all sampling and analyses are completed. The concrete will be managed at the appropriate disposal facility once characterization is completed and the specific profile is identified. To prevent rain from entering the vault, a watertight, sheet metal enclosure was fabricated and attached to the top of the vault.

7.2.9 Closure Certifications

Closure of the B-419 underground wastewater system piping was certified by Rueben H. Chow, California Registered Professional Mechanical Engineer, of Chow Engineering, Oakland, California, on January 11, 1996, and March 7, 1997. Copies of these certifications are included in *File Index: Chronology of Agency Correspondence,* **Volume 3.**

7.2.10 2007 Structural Sampling and Analysis Program Summary

Bulk samples from 36 locations within the facility structure were collected based on information collected as a result of previous sampling and analysis activities and visual inspection of the walls, ceilings and floor tile of room 155. The protocols outlined in Appendix A, Sampling and Analysis Plan for the Building 419 Facility, were followed for this sampling event. The sampling results showed heavy metals and organic chemical compounds residues in rooms 155 and 167. See Appendix D for details.

8. 0 Closure Performance Standards

The intent of this closure plan is to eliminate, to the extent necessary to protect human health and the environment, the potential post-closure escape of residual contaminants or the migration of waste decomposition products to the ground, surface water, or atmosphere. All closure activities will be conducted in such a way as to minimize threats to human health and the environment.

8.1 Structure and Equipment

Analytical data has been evaluated for the walk-in hoods and structure excluding the concrete floor. See section 4.5 for the results of the evaluation. The contaminated material will be properly packaged and stored prior to ultimate disposal at an authorized off-site facility.

Performance standards to be met in conducting closure of the B-419 Facility equipment and structure are achieved through the following processes:

- Based on analytical results, the walk-in hoods will be evaluated for disposal against the off-site facility's WAC.
- If feasible, decontamination procedures for cement floor and asphalt surfaces will be implemented so that no residues resulting from hazardous waste operations will remain.
- Verification sampling will be conducted of the asphalt and concrete floor in accordance with the SAP in **Volume 1, Appendix A**.
- Decontamination solutions, debris, and wastes will be collected and characterized for hazardous waste and radioactive constituents for disposal or storage at an approved, permitted, on-site or off-site TSDF.

8.2 Soil and Groundwater

LLNL understands that in California different regulatory structures exist for closure and clean-up actions for soil and ground water. Typically, the choice of which regulatory structure would take precedence in a closure action is largely dependent upon the status of the original operation(s). In the case of LLNL, past and current operations fall into categories that have triggered the need to comply with both RCRA and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements.

The LLNL Livermore site has been on the National Priority List (NPL) since 1987. As a part of the CERCLA process, State and Federal regulatory agencies are actively involved in clean-up decisions and actions. The agencies include the Regional Water Quality Control Board (RWQCB), DTSC Site Mitigation Branch, and the EPA. The Remedial Project Managers from DOE, EPA, RWQCB, and DTSC meet every 6–8 weeks to discuss ongoing work. This group also meets with representatives of the public in a quarterly Technical Assistance Grant meeting and the Community Work Group approximately twice a year.

In support of the Building 419 Closure Plan, LLNL will complete characterization of soil collected from locations throughout the LLNL site in order to develop background levels for metals and radioactivity. The analytical results from concrete-asphalt-soil samples collected within the Building 419 Facility boundaries, identified by the prefix "CAS", will be compared to the maximum allowable concentrations for metals in soil and the radiological background levels established by the additional site-wide soil sampling campaign, to determine if "clean closure" cleanup levels are achieved. DTSC will participate in the process of determining the number of concrete-asphalt-soil samples collected from within the Building 419 Facility boundaries to perform isotopic speciation on.

The statistical Multi-Agency Radiation Survey and Site Investigation Manual [MARSSIM]) method was used to determine the number and locations of soil samples to be obtained to develop background levels for metals and radioactivity. As recommended by MARSSIM, the background levels will be developed by collecting soil samples from random locations throughout the LLNL site. For this project, a minimum of 35 randomly selected soil sampling locations are required by the MARSSIM methodology. All potential soil sampling locations are identified in Figure A-3 of the SAP.

The "clean close" standard for organics at the site will be a human health risk of 1×10^{-6} or less (that is, one in one million elevated cancer risk) and a hazard index of less than 1.0.

8.2.1 Soil Contamination

In the event that soil sampling associated with proposed final closure activity at the B-419 Facility identifies contamination areas in the unsaturated zone that are a result of the facility's operations, LLNL will either clean up the contaminated soil to allow clean closure to occur; or, if clean closure cannot be achieved, LLNL will submit a post-closure permit application to DTSC describing how the remaining contamination will be managed.

LLNL may also demonstrate clean closure for the purposes of RCRA on a risk-based approach.

8.2.2 Ground Water Contamination

LLNL will submit a current conditions report for deep soils and groundwater once closure activities have been implemented. LLNL will submit a description of the ground water clean-up activities and monitoring programs taking place under CERCLA, along with an evaluation of how the activities meet the substantive requirements of RCRA. If ongoing CERCLA activities can not demonstrate that the substantive requirements of RCRA can be met, LLNL will set up a program (upon further discussion with DTSC) to monitor and clean up the contamination in conjunction and consistent with the CERCLA program. This program would be described in the post-closure permit application. Should they be necessary, the post-closure plan and post closure permit application will be submitted to DTSC for approval.

LLNL would show in all situations that clean up or monitoring activities would meet the RCRA substantive requirements, including public participation requirements.

9.0 Site Safety and Health Plan

The Site Safety and Health Plan (SSHP) covers activities implemented to protect workers and the environment during closure activities. If contractors are hired to perform B-419 Facility closure activity they will be required to follow LLNL's general health and safety requirements and will provide a safety plan for their specific activities. These requirements are documented in **Volume 1, Appendix B,** which contains Section 3.2.4, Subcontractor Safety Plan, of Document 2.5, Procured Services ES&H Program, of the *Environment, Safety, and Health Manual* (LLNL, current version).

Health and safety issues and standard operating procedures for the specific closure will be addressed, as described in **Volume 1, Appendix B**. Closure activities will be monitored by LLNL's closure project leader and the Site Safety Officer (SSO).

10.0 Training for Performing Closure Tasks

All personnel who participate in closure activities at the B-419 Facility will have appropriate training to perform the assigned tasks. Appropriate training for LLNL personnel is conducted through the RHWM Division training program, which is designed to meet regulatory requirements and provide personnel with knowledge of how to safely operate the LLNL waste management facilities.

Any contractors or their subcontractors, as part of the contract requirements, must also provide evidence of employee training to perform hazardous and mixed waste management activities. Contractors who implement decontamination, sampling, and/or demolition procedures associated with this Closure Plan will be trained to follow LLNL's waste acceptance criteria.

All employees, contractors, and subcontractors conducting closure activities will be provided with a briefing on this Closure Plan.

11.0 Closure Certification

If sample analyses verify that contamination from the B-419 Facility hazardous waste operations did not enter the soil, the facility will be considered closed. LLNL will provide a final Closure Report and certification of closure to DTSC within 60 days of completion of the closure activities described in this Closure Plan.

An independent, California-registered, professional engineer will oversee all closure activities to certify that these activities have been performed by qualified individuals and were completed in accordance with this Closure Plan. This engineer will monitor closure activities, review logbooks, sampling and analytical data, and other closure records to certify that all activities have been properly completed. The independent engineer will not be from the owner or operator organizations. The independent engineer will maintain documentation of his/her closure inspections and reviews of all analytical and other data generated during closure. The final closure certification will be submitted within 60 days after the completion of closure.

12.0 Document Maintenance

The following documentation will be maintained during closure activities and will be provided in the final Closure Report:

- Daily activity logs.
- Contractor safety documentation.
- Sampling and analytical data.
- Records of type and quantity of hazardous and mixed waste generated during closure activities.
- Disposition of hazardous and mixed waste generated during closure activities, including transfer/shipping documents.

13.0 Closure Milestones

The closure milestones include structural decontamination and sampling, structure dismantling/demolition, soil sampling, pipe removal, and soil excavation activities, if any. The order of the milestones could change based on field conditions or other conditions. A milestone chart for closure activity is included as **Figure 7.**

14.0 Closure Monitoring

LLNL representatives will monitor all closure activities described in **Sections 4, 5,** and **6** to verify that the activities are being conducted in accordance with this Closure Plan. An independent, California-registered, professional engineer, as described in **Section 11** of this Closure Plan, will also monitor closure activities.

15.0 Closure Cost Estimates and Post-Closure Cost Estimates

According to 22 CCR 66265.140(c), the federal government as the owner and operator of LLNL is exempt from the requirements to provide cost estimates and financial assurance mechanisms for closure actions. Federal facilities are also exempt from the post-closure care financial requirements, which include Cost Estimate for Post-Closure Care and Financial Assurance for Post-Closure Care specified in 22 CCR 66265.144 and 145.

16.0 Regulatory Agency Notification

Notification will be given to DTSC 60 days before closure activities begin. DTSC will also be notified in the event that any unexpected events require an extension of the time permitted to conclude closure activities.

17.0 Post Closure/Post-closure Plan

A Post-closure Plan will be prepared in the event that contamination from the B-419 Facility hazardous waste operations is discovered in soil or ground water, and the area cannot be "clean closed." LLNL will submit any Post–closure Plan to DTSC for review and approval.

18.0 References

California Code of Regulations (CCR), Title 22, Chapter 11, Section 66260.10, Definitions (22 CCR 66260.10).

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19.0 Acronyms

ACM	Asbestos Containing Material
ASTM	American Society for Testing and Materials
BAAQMD	Bay Area Air Quality Management District
CAL/EPA	California Environmental Protection Agency
CCR	California Code of Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSU	Container storage unit
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DTSC	California Department of Toxic Substances Control
DWTF	Decontamination and Waste Treatment Facility
EPA	U.S. Environmental Protection Agency
ES&H	Environmental, safety, and health
FFA	Federal Facility Agreement
HEPA	High-efficiency particulate air (filters)
LDRs	Land disposal restrictions
LLNL	Lawrence Livermore National Laboratory
LOS	Level of sensitivity
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual

LWRP	Livermore Water Reclamation Plant
MDL	Method Detection Limit
NPL	National Priority List
RACM	Regulated Asbestos Containing Material
RCRA	Resource Conservation and Recovery Act
RHWM	Radioactive and Hazardous Waste Management
ROD	Record of Decision
RWQCB	Regional Water Quality Control Board
SAP	Sampling and Analysis Plan
SF	San Francisco
SSO	Site Safety Officer
SSHP	Site Safety and Health Plan
STLC	Soluble Threshold Limit Concentration
TCLP	Toxicity Characteristic Leaching Procedure
TSDF	Treatment, storage, and disposal facility
TTLC	Total Threshold Limit Concentration
TRU	Transuranic
TSI	Thermal System Insulation
U.S.	United States
UST	Underground storage tanks
VOC	Volatile organic compound
WAA	Waste Accumulation Area
WAC	Waste Acceptance Criteria
WET	Waste Extraction Test
ZHE	Zero headspace extraction

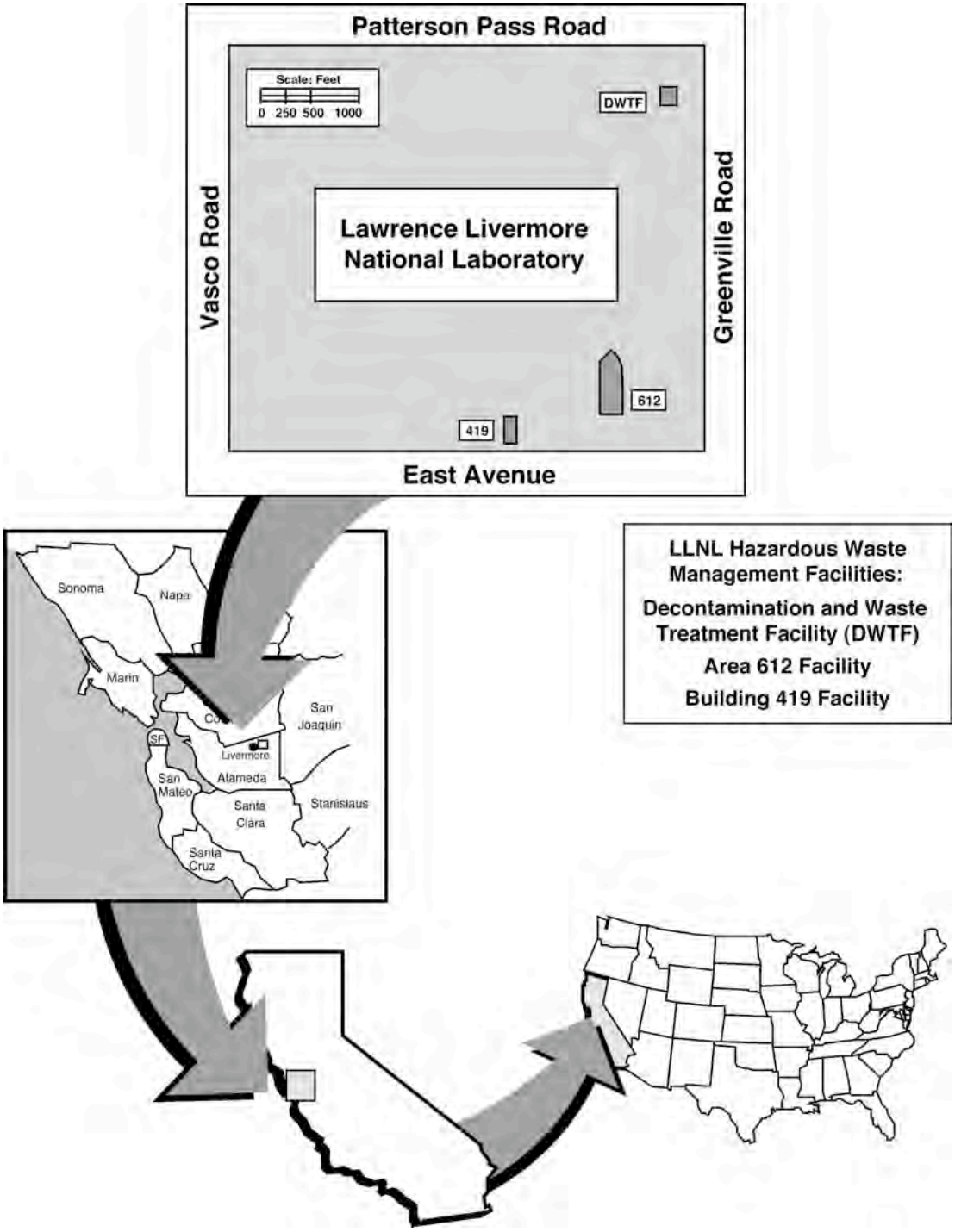

Figure 1. Location of the B-419 Facility at LLNL

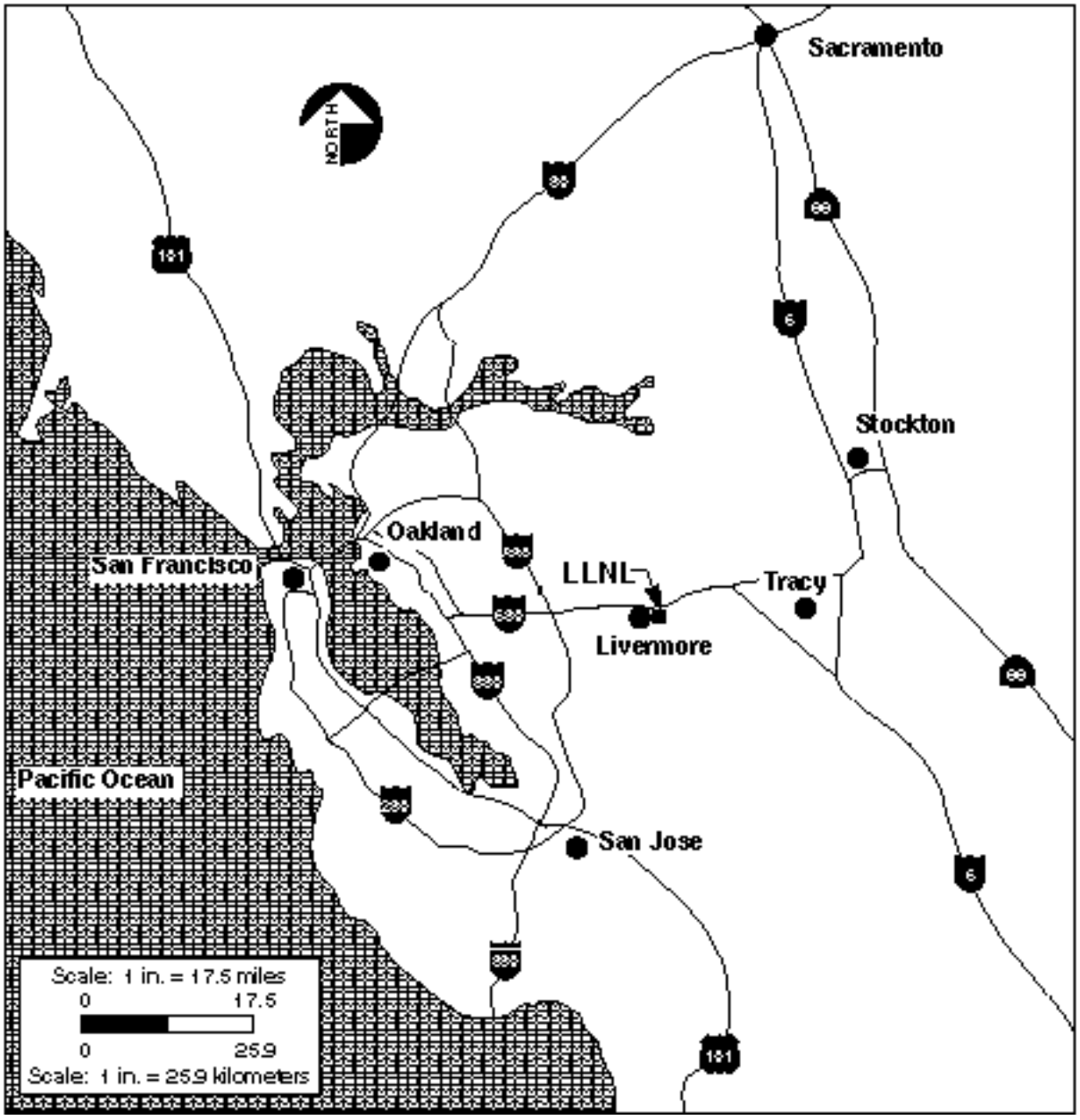

Figure 2. Location of Lawrence Livermore National Laboratory

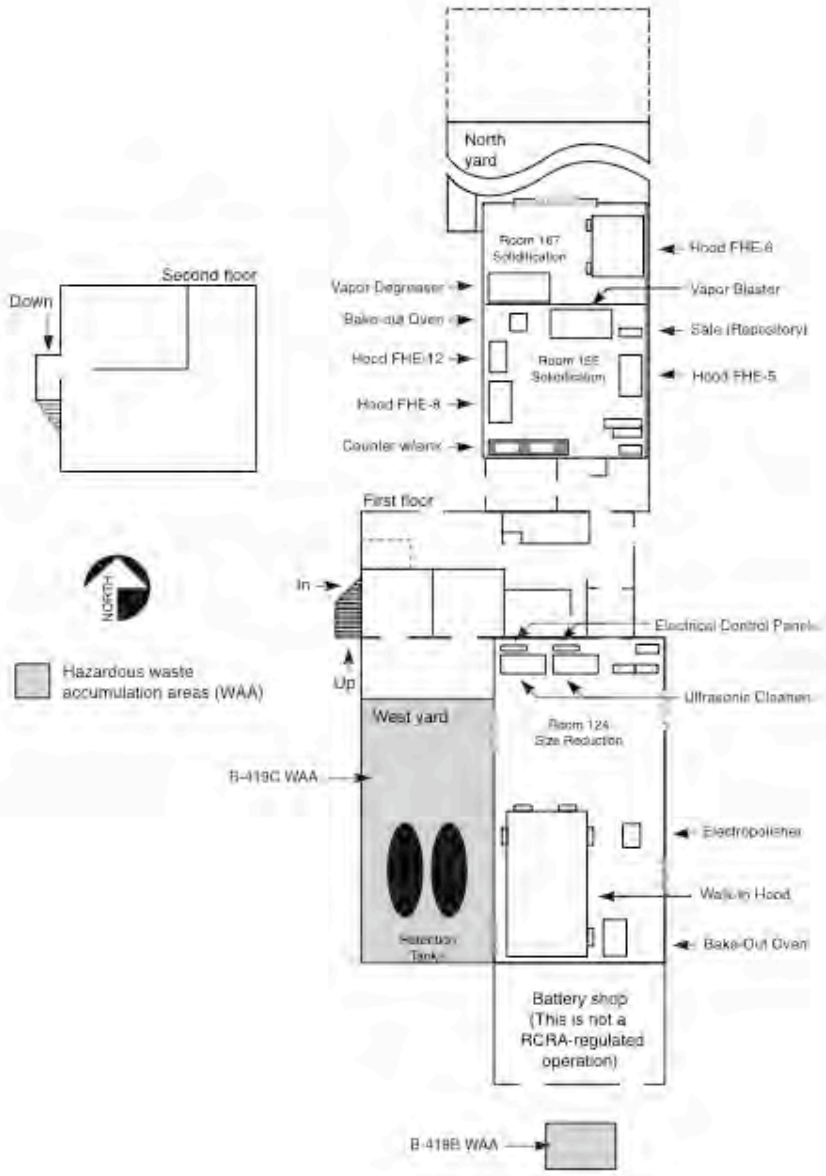

Figure 3. B-419 Layout

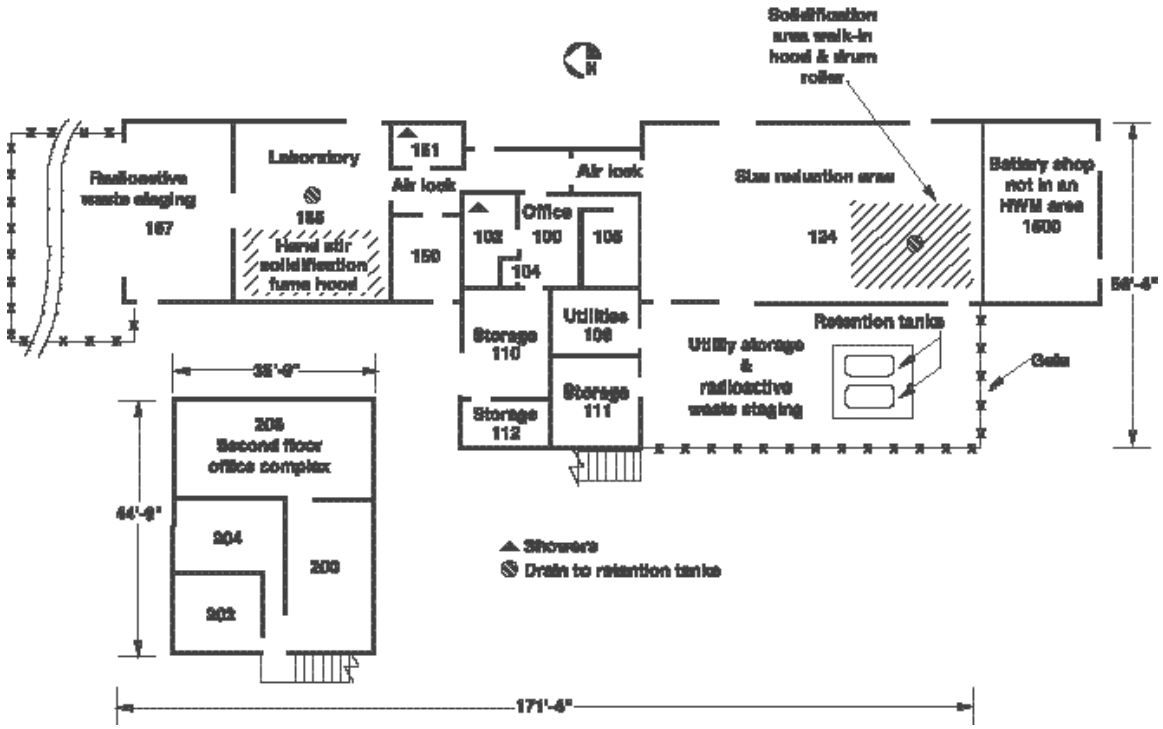

Figure 4. B-419 Size Reduction Area Location

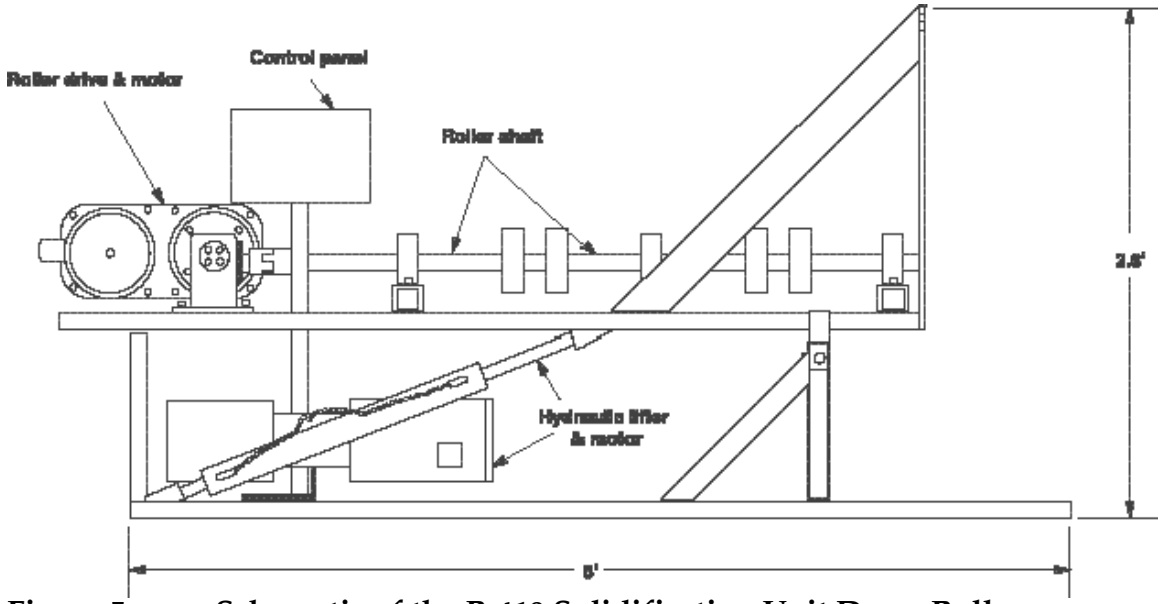

Figure 5. Schematic of the B-419 Solidification Unit Drum Roller

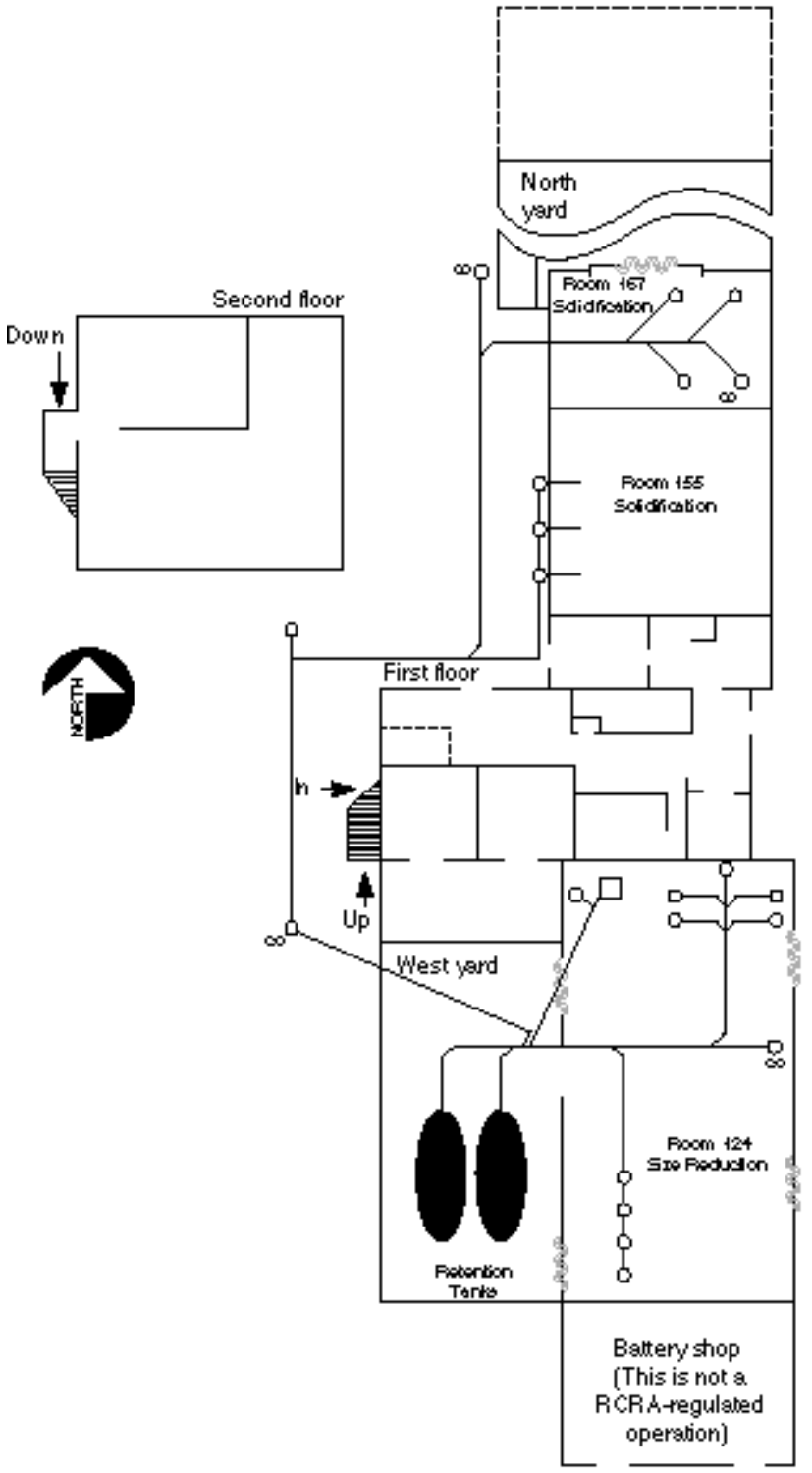

Figure 6. Schematic of the B-419 Retention Tank System

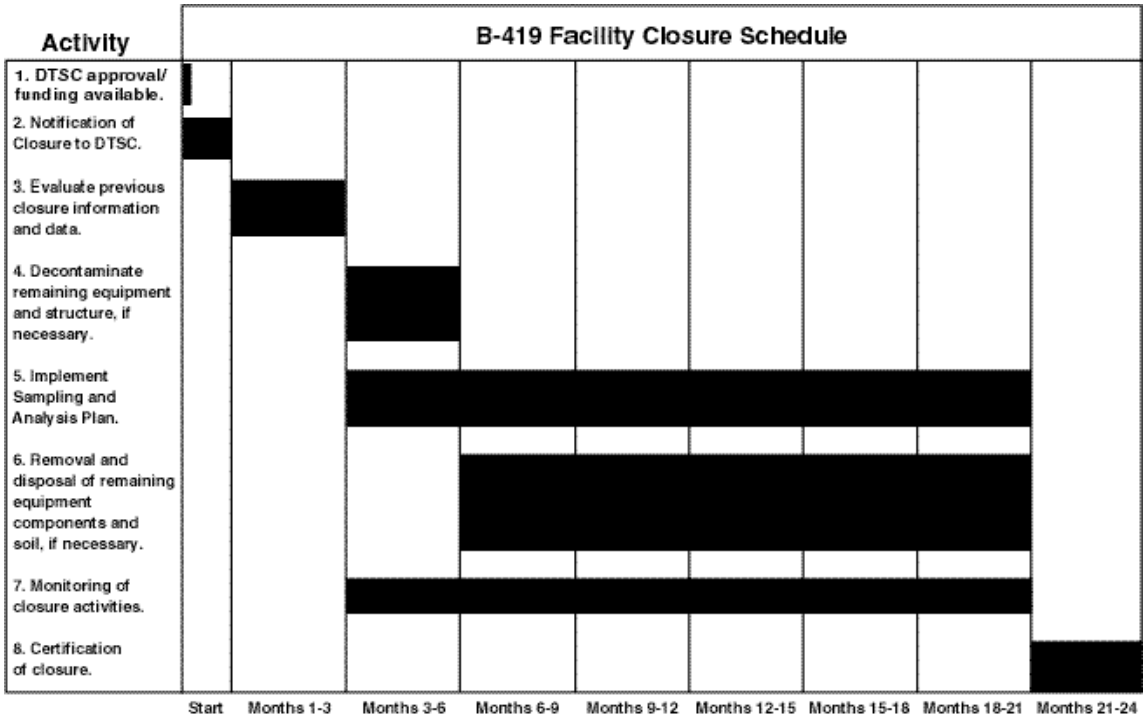

Figure 7. Closure Plan Implementation Milestone Chart for the B-419 Facility

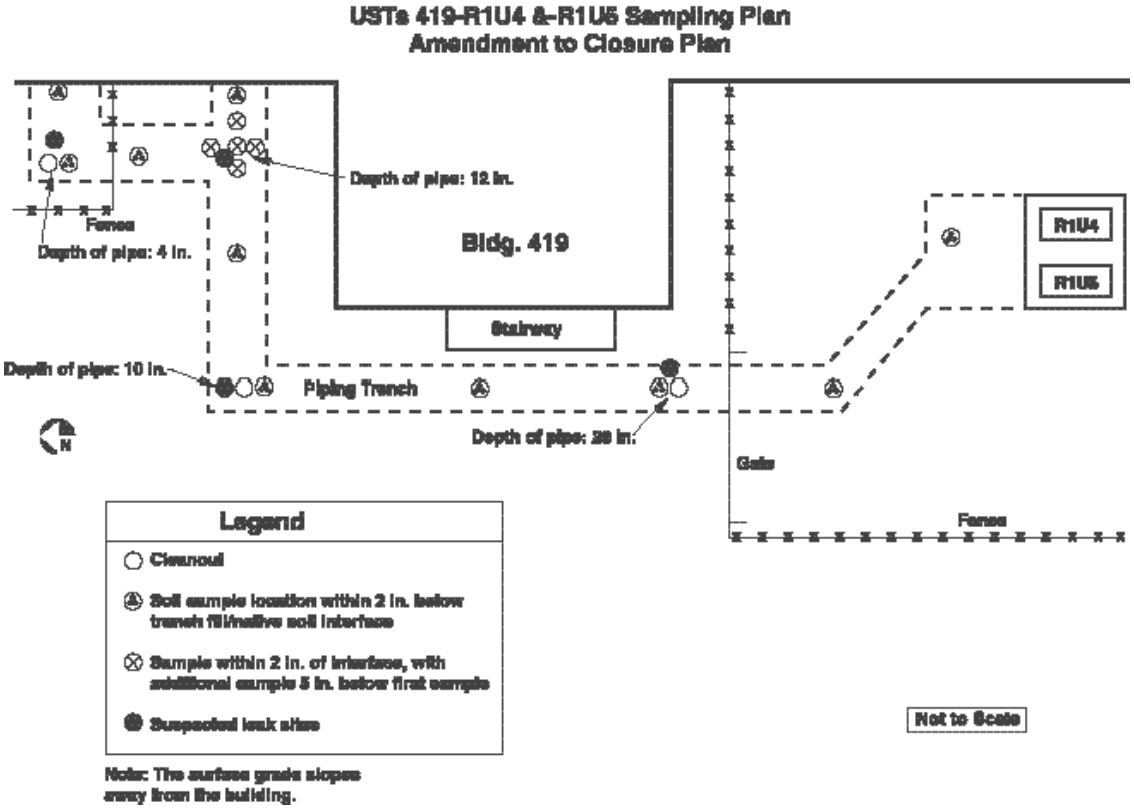

Figure 8. Suspected Leak Sites in the Building 419 UST Piping

Table 1. Potential Historical Contaminants at the B-419 Hazardous Waste Treatment Facility

Potential Historical Contaminants in the Size Reduction Unit	Potential Historical Contaminants in the Solidification Unit
Toxic metals, including beryllium, copper, chromium, arsenic, nickel, cadmium, mercury, and lead	1,1-Dichloroethylene
Oil (lubricating oils, diffusion pump	1,2-Dichloroethane
Oils) and grease	1,4-Dichlorobenzene
Radionuclides	Acids and bases
Freon	Carbon tetrachloride
Methylene chloride	Chlorobenzene
TCE	Chloroform
PCE	Toxic metals
Methyl ethyl ketone	Methyl ethyl ketone
	Oil and grease
	Pyridine
	Radionuclides
	Spent cyanide plating solution
	Spent cyanide stripping solution
	Spent halogenated solvents
	Tetrachloroethylene
	Trichloroethylene

Table 2. Parameters for Analysis and Analytical Methods for Bulk Samples, Swipes, and Wastewater Generated from Decontamination Activities

Parameter/Constituent	Method[a]
Hazardous metals	California WET
Volatile organic compounds	1310
Antimony	6010
Arsenic	7061
Barium	6010
Beryllium	6010
Cadmium	6010
Chromium (total)	6010
Chromium VI	7199
Copper	6010
Total Cyanide	9010
Lead	6010
Mercury	7470 or 7471
Nickel	6010
Selenium	7741
Silver	6010
Thallium	6010
Vanadium	6010
Zinc	6010
Volatile halogenated organics	8260
Volatile aromatic	8260
Semi volatiles	8270
Gross alpha	9310
Gross beta	9310
Tritium	906
Oil and grease	9070

[a] Refers to EPA, 1986, unless otherwise noted.

ASTM = American Society for Testing and Materials.

WET = Waste Extraction Test.

Table 3. Decontamination Approaches

Contaminant	Localized Area	Widespread Area
Radioactive materials	1. Cloth wipes and detergent[a] 2. Mild acid solution[b] 3. Removal[b]	1. High-pressure steam and water 2. Mild acid solution[b] 3. Removal[b]
Metals	1. Cloth wipes and detergent[a] 2. Chelating agent (EDTA disodium salt) 3. Removal	1. High-pressure steam and water 2. Chelating agent (EDTA disodium salt)[b] 3. Removal[b]
Oil and grease	1. Cloth wipes and detergent[a] 2. High-pressure steam and water[b] 3. High-pressure steam with trisodium phosphate[b]	1. High-pressure steam and water 2. High-pressure steam with trisodium phosphate[b] 3. Removal[b]

[a] Detergent to be used must contain trisodium phosphate.

[b] Will be used if first procedural step fails to remove contamination.

References: Unterberg and Melvoid et al, 1980; Esposito, 1987.

Table 4. Estimates of Quantities of Waste to be Generated During Decontamination Activities

Waste Type	Estimated Quantity to Be Generated	Decontamination or Disposition Method
Disposable rubber gloves, boots, and other personnel protective gear	150 ft^3	Containerize for off-site disposal.
Miscellaneous rags, paper, and disposable sampling materials	50 ft^3	Containerize for off-site disposal.
Spent decontamination liquids	1500 gal	Store for on-site treatment or containerize for off-site treatment and/or disposal.

Table 5. Containers Used to Manage Waste Generated during Closure Activities

Container Type	UN Specifications	Lining	Waste Type
55-gal steel drum	UN 1A1, UN1A2 (with inner containers)	Appropriate liner, if required	Waste oils, photochemicals, halogenated solvents, flammable solvents, waste paints
5-gal polyethylene and Nalgene carboys	UN 1H1	None	Waste acids, photochemicals
55-gal steel drum	UN 6HA1	Polyethylene bladder	Waste acids, photochemicals
30-gal steel drum	UN 1A2	Appropriate liner, if required	Ash, dirt, miscellaneous dry waste
Various sizes (>119-gal capacity), wooden or steel boxes	UN 11G, Non-DOT spec	Appropriate liner, if required	Asbestos, miscellaneous equipment, solid waste
5-gal steel can	UN 1A2	Appropriate liner, if required	Solid and liquid waste, aerosols, miscellaneous small items to be overpacked in container
55-gal steel drum	UN 1A2	Appropriate liner, if required	Ash, solid waste, miscellaneous equipment
5-gal, polyethylene container with cap	UN 1H1	None	Aqueous/organic solutions
5-gal, metal can with screw cap	UN 1A1	None	Aqueous/organic solutions, halogenated and flammable solvents
5-gal can with lid	UN 1A2	Appropriate liner, if required	Solid and liquid waste, aerosols, miscellaneous small items to be overpacked in container
85-gal steel overpack drum	UN 1A2	Appropriate liner, if required	Overpack for leaky, bulging, or damaged 55-gal drums
110-gal, steel overpack drum	UN 1A2	Appropriate liner, if required	Overpack for leaky, bulging, or damaged 55-gal drums
Lift Liner™	Non-DOT spec (Meets general design requirements)	Appropriate liner, if required	Solid waste, miscellaneous equipment
Cargo container 8'x8.5'x20' (transportainer)	Non-DOT spec (Meets general design requirements)	None	Solid waste, miscellaneous equipment
330-gal, polyethylene portable tank	UN 31H, Non-DOT spec	None	Aqueous solutions of: waste acids, photochemicals, caustic waste, organic/inorganic solutions
600-gal, polyethylene portable tank	UN 31H, Non-DOT spec	None	Aqueous solutions of: waste acids, photochemicals, caustic waste, organic/inorganic solutions, oil, halogenated solvents, flammable solvents
625-gal, stainless-steel portable tank	UN 31A, Non-DOT spec	None	Aqueous solutions of: waste acids (no HCl), photochemicals, caustic waste, organic/inorganic solutions, oil, halogenated solvents, flammable solvents

Table 5. Containers Used to Manage Waste Generated during Closure Activities (continued)

Seamless steel cylinder	DOT specification 3A and 3AX	None	Compressed gas
Seamless steel cylinder	DOT specification 3AA and 3AAX	None	Compressed gas
Seamless steel cylinder	DOT specification 3B	None	Compressed gas
Seamless nickel cylinder	DOT specification 3BN	None	Compressed gas
Container Type	UN Specifications	Lining	Waste Type
Steel cylinder with porous fillings	DOT specification 8	None	Compressed gas; acetylene
Steel cylinder with porous fillings	DOT specification 8AL	None	Compressed gas; acetylene
Non-reusable (non-refillable) cylinder	DOT specification 39	None	Compressed gas
Lecture bottles and other small non-spec cylinders and spheres	None	None	Compressed gas

DOT = U.S. Department of Transportation.

Table 6. B-419 Hazardous Waste Management Equipment Disposition

Item Description	Disposition
Parts Washer	Scrap
Sink	Scrap
Vapor Degreaser	Scrap
Pallet of Misc. Parts	Scrap
Box # 2	Scrap
Locker	Scrap
Safe	Scrap
Electropolisher	Scrap
FHE 5 Large pc	LLW/NTS
Wood Pieces	LLW/NTS
FHE 8 Metal Parts	Scrap
Wood FHE 8	Scrap
Light Housing	Scrap
FHE 5/ Vapor Degreaser Parts	Scrap
FHE 8 Parts	Scrap
Wooden Box	LLW/NTS
Lab Table	Scrap
Vapor Blaster Wood Parts	LLW/NTS
Vapor Blaster Parts	LLW/NTS
FHE 8 & FHE 12 Fume hood Parts	Scrap
Metal Steps	Scrap
Wooden Table Top	LLW/NTS
Cavitation Instrument	Scrap
Mercury Oven Vent Opening	Scrap
Ultra Sonic Cleaner #1	Scrap
Misc. Pcs Vapor Degreaser; Basket–Parts Washer	LLW/NTS
Ultra Sonic Cleaner #2	Scrap
Electrical Panel	Scrap
Transformer Power Unit	LLW/NTS
Light Housing	Scrap
Mercury Bake-out Oven Parts-B-155	LLW/NTS
Mercury Bake-out Oven Parts-B-155	Roll-Off
Mercury Bake-out Oven Parts-B-155	Roll-Off
Mercury Bake-out Oven Parts-B-155	Roll-Off
Mercury Bake Out Oven Walls-B-155	Roll-Off
Mercury Bake Out Oven	LLW/NTS
Motor/Sheet Metal/Bearings	LLW/NTS
FHE#8 4Pc in Plastic	LLW/NTS/Envirocare
Pipe Legs	Scrap
5 Pc Repository Ducting (3-H)	Scrap
FHE 12 Blower/Stack 3Pc	Scrap

Table 6. B-419 Hazardous Waste Management Equipment Disposition

Item Description	Disposition
FHE 12 Ducting	Roll-Off
FHE 5 Ducting	Scrap
FHE 5 & 12 Ducting 2 Pc	LLW/NTS
Repository Ducting	LLW/NTS
Repository/H3	LLW/NTS
Mercury Tritium Oven Ducting	LLW/NTS
Mercury Tritium Oven Vent	Roll-Off
FHE 4 Ducting 5 Pc	Scrap
FHE 5 Ducting 2 Pc	LLW/NTS
FHE 8 Blower & Stack 3 Pc	Scrap
FHE 12 Ducting 2 Pc	LLW/NTS
FHE 4 Filter Housing w/Motors	Scrap
FHE 5 Filter Housing w/Motor	LLW/NTS
FHE 5 Filter Housing	Scrap
FHE 5 Filter Housing	Scrap
FHE 4 Ducting	Scrap
Stainless Steel, FHE-8 3 Pc	Scrap
2 Repository Motors	LLW/NTS
Mercury Stack	LLW/NTS
Stainless Steel 2 Pc	Scrap
FHE 4 Filter Housing (size reduced)	Scrap
Ducting from HEPA, Motors, Flashing	Scrap
Hg Oven Stack (124) 5 pcs., flashing	Roll-Off
Flander's Unit	Scrap
Non Compactable Fittings 8-21-95	LLW/NTS
55 Gal Blower Housing Assy 1/21/96	LLW/NTS
Trash 10/13/95 2□4□7 (7A)	NTS/Envirocare
Trash 8/21/95 2□4□7 (7A)	NTS/Envirocare
Vapor Degreaser 1/21/96 4□4□8	NTS/Envirocare

LLW /NTS = Low-level waste/ Nevada Test Site.
Roll-off = Items dispositioned to a Class 2 landfill.